CLAIMS

1. A synthesis method for synthesizing a $Si/C/N/E_a/F_b/G_c/O$ multielement nanopowder directly suitable for sintering, where E, F, and G represent three distinct metallic elements other than Si, and at least one of a, b, and c is non-zero, the method being characterized in that it comprises the following steps:

· using an aerosol generator to generate an aerosol comprising at least one metal precursor containing at least one of said metallic elements, and hexamethyldisilazane $Si_2C_6NH_{19}$ used as a main source of Si and as the sole solvent for said at least one metal precursor;

· adding to said aerosol silane SiH_4 or its equivalent in gaseous form so as to form a reaction mixture; and

· proceeding with laser pyrolysis of said reaction mixture.

2. A synthesis method according to claim 1, characterized in that said metallic elements are selected from Al, Y, Mg, Yb, and La.

3. A synthesis method according to claim 1 or claim 2, characterized in that at least one metal precursor comprises yttrium isopropoxide $C_9H_{21}O_3Y$.

4. A synthesis method according to any one of claims 1 to 3, characterized in that at least one metal precursor comprises aluminum secbutoxide $C_{12}H_{21}O_3Al$.

5. A synthesis method according to any one of claims 1 to 4, characterized in that at least one metal precursor comprises aluminum isopropoxide $C_9H_{21}O_3Al$.

6. A synthesis method according to any one of claims 1 to 5, characterized in that ammonia NH_3 or its equivalent, in gaseous form, is also added to said aerosol.

7. A method of fabricating a composite ceramic, characterized in that: a $Si/C/N/E_a/F_b/G_c/O$ multielement nanopowder directly suitable for sintering is synthesized using the synthesis method according to any one of claims 1 to 6; and said nanopowder is sintered directly.

8. A $Si/C/N/E_a/F_b/G_c/O$ multielement nanopowder in which E, F, and G represent three distinct metallic elements, other than Si, and at least one of a, b, and c is non-zero, characterized in that it is directly suitable for sintering without needing to be subjected to a prior mixing or annealing step, in that each nanopowder grain contains all of the elements Si, C, N, E_a, F_b, G_c, and O, and in that it presents a chemical composition expressed in terms of equivalent stoichiometric compounds, as determined by calculation from element analysis, such that the free carbon content is less than 2% by weight and the SiO_2 content is less than 10% by weight.

9. A nanopowder according to claim 8, characterized in that the metallic elements E, F, and G are selected from Al, Y, Mg, Yb, and La.

10. A nanopowder according to claim 9, characterized in that the metallic elements E and F are respectively aluminum Al and yttrium Y.

11. A nanopowder according to any one of claims 8 to 10, characterized in that the index c of G_c is zero, such that the nanopowder contains only the two metallic elements E and F.

12. A nanopowder according to claim 10 or claim 11, characterized in that the chemical composition expressed in

terms of equivalent stoichiometric compounds, determined by calculation from element analysis, is such that the sum of the contents of Al_2O_3 and Y_2O_3 is greater than 3%.

13. The use of a $Si/C/N/E_a/F_b/G_c/O$ multielement nanopowder according to any one to claims 8 to 12 for fabricating a composite ceramic.

14. A composite ceramic of the Si_3N_4/SiC type prepared from a $Si/C/N/E_a/F_b/G_c/O$ multielement nanopowder where E, F, and G represent three distinct metallic elements, other than Si, and where at least one of a, b, and c is non-zero, that is suitable for being obtained by the fabrication method of claim 7, and characterized by the fact that the grains constituting it are of a size smaller than 100 nanometers.

15. A composite ceramic according to claim 14, characterized in that it presents density that is equal to at least 99.5% of its theoretical density.